BIBLIOGRAPHICAL NOTICES.

ART. XIV.—*Fifth Annual Report of the Registrar-General, of the Births, Deaths and Marriages in England.* London, 1843: 324 pages: folio.

WE have noticed at considerable length, the previous reports of the Registrar-General, and enriched our pages with the valuable facts which they present.* The one now before us shows an increased attention devoted to the acquisition of information relating to the conditions and changes taking place in the dense population of England. The tabular statements, of which the large folio volume is chiefly made up, exhibits in minute detail, the marriages, births and deaths, not only for the metropolis and large towns, but in the various rural districts in England and Wales. The causes of death are severally stated, and comparative views presented which add great interest to the statistical labours of George Graham, Esq., the Registrar-General, and others employed under him.

In the previous reports, the abstracts of the causes of death were not made up at the close of each year, but extended to the 30th of June. The disadvantages of this arrangement being recognized, the plan of adhering to the ordinary year has been adopted. As the census was taken nearly in the middle of 1841, the marriages, births, deaths, and causes of death, are all made up for that year.

In the fourth report it was stated that the population of England increased in the 10 years, 1831–1841, at the rate of 1.334 per cent. annually, and that, in comparing the marriages, births and deaths, of each year with the population, it had always been assumed that the rate of increase was uniform.

The marriages in 1841 were 1 in 130; the births, 1 in 31; the deaths, 1 in 46 of the population. The average of the two preceding years had been, of marriages, 1 in 127; births, 1 in 31; deaths, 1 in 45. The rate per cent. of the marriages, births and deaths, in 1841, compared with the population, would stand thus in decimals: 0.769 marriages, 3.217 births, and 2.160 deaths occurred to 100 living; or without decimals: 769 marriages, 3217 births, and 2160 deaths, to every 100,000 of the population.

In regard to the marriages, a slight diminution is obvious in every year. In the 11 divisions in which the kingdom has been arranged, in order to exhibit the proportion of marriages, the fluctuation in some was too slight to merit attention; but in others, the variations coincide with the depression or prosperity of industry or trade, indicating the view which the people took of their own circumstances, and the greater or less immediate facility of making provision for the support of families. The marriages in the Welsh division show a progressive decline. The most remarkable decrease is in Monmouthshire, where the total marriages in the three years 1839—1841, were 1403, 1308, and 1119.

The greatest number of marriages (36,502) take place in autumn, and the smallest number (25,174) in winter. The difference between the extremes is 11,368; and the four seasons stand in the following order:—

	Winter.	Summer.	Spring.	Autumn.
	January, February, March,	July, August, September,	April, May, June,	October, November, December,
Average (1839–41)	25,174	29,502	31,558	36,542

"The marriages in winter (25,174) are to those in spring (31,559) very nearly as the marriages in summer (29,502) are to the marriages in autumn (36,542): and the marriages in winter are to those in summer, as the marriages in spring to the marriages in autumn. The marriages in the four quarters are therefore the terms of a proportion; and the marriages in any three quarters being given, the number of marriages in the other quarter can be deduced from them within a few hundreds either by the common rule of three, or as the terms are nearly equidifferences, by adding two terms and subtracting the third. The regularity in the numbers registered in each of the three years indicates the operation of constant causes, or such as fluctuate only in the same way as those which adjust the proportion of marriages to the population.

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* See American Journal of Med. Sci. for January and July, 1841, and Oct., 1842, and Jan., 1844.

"Lent and Christmas have probably some influence in fixing the time of marriage, and in causing the difference of 11,368 marriages in the March and December quarters. But the December quarter follows the season of the agricultural labourer's greatest earnings, when wages are highest and the stores of winter are laid up; whilst at the close of winter labour is scarce, wages fall, and the accumulations of autumn are nearly exhausted.

"If the physical condition of the people have any influence, we might expect this to be most manifest where the earnings of the majority of the population are derived from agriculture; which is found to be generally the fact. In the manufacturing counties, where the wages of the operatives are not much influenced by the seasons, the excess of marriages in autumn is considerable, whilst in the metropolis the excess of marriages is in the summer quarter, at the close of the London season."

The number of persons married who signed the registers with marks remains the same; 33 in 100 of the men, and 49 in 100 of the women married in 1841, did not sign their names. In some parts of the country, 51 in 100 men, in others, 71 in 100 women did not write their names. This last instance, representing the extreme of the illiterate scale, occurred in North Wales. The Registrar-General expresses his regret—and well he may—at being unable to report any improvement on this head.

Births.—A comparison of the births to the deaths registered in 1841, is as 512,158 to 343,847, or 149 to 100. *Three births*, therefore, are registered to every *two deaths*.

The increase in the births was greatest in the northern division and in the metropolis. The greatest number of births is registered in the winter quarter; the smallest number in summer.

Illegitimate births.—It is not stated distinctly in the registers of births whether children are or are not born in wedlock; but as various circumstances on the face of the register infer the fact, the Registrar-General was enabled to have the illegitimate and legitimate births in the last two quarters of 1841, carefully abstracted. "Of 248,554 children registered," he observes, "15,389 were illegitimate: so 1 in 16 children born in England is not born in wedlock. This is a much higher proportion of illegitimate births than has been generally given; but the numbers are not exaggerated; for if any doubt arose in making the abstracts, and the matter appeared dubious, the child was invariably set down as legitimate. If again there are any defects in the registration of births, it is not probable that illegitimate children will be entered in undue numbers; so that I can discover no grounds for supposing that less than 64 in 1000 English children are illegitimate. The proportion in France is 71 in 1000.

"I showed in the Fourth Annual Report that the proportion of boys to girls born in England was 10,486 to 10,000. The mathematical questions connected with the proportion of the sexes born have been investigated by Laplace, Poisson, Babbage, and other distinguished philosophers; and one of the results which has attracted most attention and created most speculation is, that the proportion of boys is greatest among legitimate children. In France, for instance, the boys are to the girls born as 106·4 to 100·0; but among illegitimate children the proportion is 104·4 to 100·0 The present return gives a result exactly the reverse; of the legitimate births the boys are to the girls as 105·4 to 100·0; of illegitimate births the boys are 108·0 to 100·0; and, small as the numbers are, the ratio differs little in the two quarters. It is, I believe, assumed in the French Returns that foundling children are illegitimate. If it be true, as is stated by those acquainted with the matter, that many of the children sent to the foundling hospitals in France are the offspring of married people, who probably abandon a greater proportion of girls than boys, it will follow (1°) that the proportion of children born out of wedlock is nearly the same in England as in France; and (2°) that the inference from the Returns of Continental States having foundling hospitals as to the relative predominance of females among natural children is fallacious. I abstain, however, from any further comments; and shall add nothing respecting the relative numbers of illegitimate children in different districts, until more extensive abstracts shall have been made."

Deaths.—The total number of deaths reported to the Registrar-General, was 355,655, for the year ending June 30th, 1841. For the year ending Dec. 30th, 1841, the amount was 343,847.

Effects of the seasons.—The deaths were more numerous (99,069) in the winter of 1841, than in the winter of any preceding year, but in the spring the decline commenced, which reduced the mortality in the following quarters below the mean mortality of the 4 years. Up to the year 1840, the deaths in the summer quarter rose regularly from 72,791 to 80,822; in the autumn from 80,833 to 89,630. The deaths in winter did not fluctuate except in 1839, when they were below the average number. If the quarters had contained the same number of days, and the population had been stationary, the deaths would have been nearly as follows:

"Four Winters	(365¼ days)	391,059	Quarterly average	($91\frac{31}{100}$ days)	97,765
Four Springs	"	356,565	"	"	89,141
Four Summers	"	302,827	"	"	75,707
Four Autumns	"	334,556	"	"	83,639
Mean - - -		346,252	Mean - - -		86,563

"If the mortality were uniformly at the same rate as in winter, 391,059 deaths would happen annually; if at the same rate as in summer, 302,827 deaths would be registered. This exhibits in a striking light the fatal effects of cold; and also of the crowding and privations to which a considerable part of the population is necessarily more exposed in cold than in warm weather.

"The average corrected number of deaths in the seasons would be—

Winter.	Spring.	Summer.	Autumn.
97,765	89,141	75,707	83,639"

By transposing the autumn and summer terms, the law is discovered which has regulated the mortality of the seasons, thus—

	Winter.		Spring.		Autumn.		Summer.
	97,765	:	89,141	: :	83,639	:	75,707
Differences		8,624		5,502		7,932	

"The terms are in proportion; the product of the two extremes is nearly equal to the product of the middle terms, or the deaths in winter are to the deaths in spring as the deaths in autumn to those in summer. The proportion is perceived when no correction has been made in the quarterly deaths registered.

	Winter.		Spring.		Autumn.		Summer.
	96,441	:	88,812	: :	84,666	:	76,333
Differences		7,629		4,146		8,333	

"Admitting that this law should continue to prevail, as the proportion is also nearly arithmetical, a very close approximation to the average number of deaths in the whole year may be deduced either from the deaths registered in spring and autumn, or in summer and winter; thus the average annual deaths in the 4 years, 1838–41, was 346,352; the deaths in spring and autumn were 173,478; and twice that number gives 346,956, only 704 above the yearly average; while the deaths in winter and summer, multiplied by 2, give 345,548, or 704 below the annual average."

To exhibit the order in which marriages, births, and deaths take place more evidently, a summary view is subjoined of the series of facts, which appear to be governed by the influence of the seasons, according to the same law of proportion.

Relative number (corrected for inequality of time) of marriages, births, and deaths, in the seasons of the year—

	Autumn.	Spring.	Summer.	Winter.
Marriages	36,306	31,355	29,634	25,482
	Winter.	Spring.	Autumn.	Summer.
Births	131,257	129,677	121,053	120,356
	Winter.	Spring.	Autumn.	Summer.
Deaths	97,765	89,141	83,639	75,707

"The seasons have most influence on the number of marriages; least on the number of births. If 100 be taken to represent the lowest average number registered in a quarter, the births rise to 108, the marriages to 142, the deaths to 129. According to the abstracts down to the present time, the births and deaths are most numerous in winter, marriages in autumn; whilst the smallest number of births and deaths occur in summer, of marriages in winter.

"It has been frequently observed that the marriages and births are most numerous where the mortality is highest; and this doctrine is borne out by the facts in a table where the mortality is raised 44 per cent. in the extreme division (Lancashire and Cheshire), the marriages and births are raised 21 per cent.; whilst a comparison of the five most unhealthy and the five most healthy divisions exhibits the same fluctuation, though to a less remarkable extent. The marriages and births are 12 per cent. higher in the five divisions where the mortality is raised 15 per cent.; and the excess of 12 per cent. in the births furnishes a number of births more than equal to the increase of deaths."

The mean temperature of the several months of the year, deduced from the observations at the apartments of the Royal Society, Somerset House, London, stand as follows:—

MONTHS.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1841	36½°	37°	49°	50°	60°	61°	62°	64°	59½°	52°	45°	43°
1831 to 1840, Average of 10 years.	38°	40½°	42°	47°	55°	62°	65°	64°	58°	52°	44½°	41°

Mr. Farr, to whose able statistical labours we have heretofore had occasion to refer, has furnished a table which must prove of the highest value to those interested in Life Insurances and Life Annuities.

In regard to this *table of mortality*, or as it has been sometimes called, *table of vitality* or *life table*, the Registrar-General has made the following observations, which, as the work is scarcely attainable in this country, and the matter of exceeding interest, we extract at some length.

"The life table was invented in England by Halley, the illustrious astronomer, who 'first ventured to predict the return of a comet which appeared accordingly in 1759.' By this simple and elegant table the mean duration of human life, uncertain as it appears to be, and as it is with reference to individuals, can be determined with the greatest accuracy in nations, or in still smaller communities. I refer to the form, and not to the mode of construction, which has been since greatly improved.

"Halley's table was calculated on the deaths in the city of Breslau, which, for various reasons, he selected from the imperfect data at his disposal 'as the most proper for a standard, and the rather for that the births did a small matter exceed the funerals.' He was aware that 'he wanted the number of the whole people' for an accurate calculation; Halley's table, constructed upon nearly the same hypothesis as the Northampton table, represented the mortality of mankind with as little inaccuracy, and was upon the whole quite as good a 'standard.' He observes, 'it may be objected that the different salubrity of places does hinder the proposal from being universal, nor can it be denied;' 'but,' he concludes, 'it is desired that in imitation hereof the curious in other cities would attempt something of the same nature, *than which nothing perhaps can be more useful.*' The table, which gave 'a more just idea of the state and condition of mankind than anything then extant, had manifold uses, showing among other things the chances of mortality at all ages, and likewise how to make a certain estimate of the value of annuities for lives, which had been previously done by an imaginary valuation.'

"The government of the revolution, it will be recollected, introduced the system of borrowing money upon life annuities, and after having failed to procure subscriptions upon the terms of the act of 1691, succeeded in making good the deficiency by granting life annuities in the following year at 14 per cent. Halley, referring to the measure in his paper, remarks that his calculation shows 'the great advantage of putting money into the present fund lately granted to their majesties giving 14 per cent. per annum, or at the rate of 7 years' purchase for a life, when young lives at the usual rate of interest are worth above 13 years' purchase.' In the ignorance then prevailing as to the duration of life, annuities were granted at the same rate to persons of every age; and Halley pointed out 'the advantage of young lives over those in years, a life of 10 years being almost worth 13½ years' purchase, whereas one of 36 is worth but 11.'[*]

"Tables of the lives of French annuitants, monks and nuns, were published by Deparcieux in 1746; and in 1783 Dr. Price constructed a correct table from the population and deaths in Sweden and Finland. This was the first national life table ever constructed, and redounds much more to Dr. Price's fame than the Northampton table of mortality—so called—which, founded upon the misapplication of an hypothesis, never represented the mortality of Northampton or of any other community, and ought not to have been published after the appearance of the admirable essay and tables of Deparcieux in 1746.[†]

"The Carlisle table was calculated by Mr. Milne, on two enumerations made by Dr. Heysham of the population of Carlisle and its environs, in 1779 and 1787, with the deaths in 9 years. The mean population was 8177, and the deaths 1840. Mr. Milne has described, in his treatise,[‡] the care with which the observations were taken, and the method employed in the construction of this justly celebrated table, which was the first correct representation of the vitality of any portion of the English population.

"'Although the *data* necessary for determining the law of mortality among the people, and the value of pecuniary interests dependent upon the continuance or failure of human life cannot be obtained,' observed Mr. Milne, in 1831, 'without the active concurrence of many persons of influence and authority, yet for all the tables containing information of that kind relative to this country, and published before the year 1829, the public were indebted to the zeal and industry, and the separate efforts of a few individuals. But in March, 1819, Mr. Finlaison was appointed by government, with all the aids they could afford him, including proper assistants, and access to the registers of the nominees in tontines, and others on whose lives annuities had been granted by government for more than a hundred years before, in which registers the exact ages at which the annuitants were nominated, and those at which they died, were stated. Thus the *data* not otherwise accessible being provided, and the labour lessened by the number of calculators employed, the expense also being defrayed by the public, at the end of 10 years, *viz.*, in March, 1829, Mr. Finlaison made a report to the lords of the treasury, which was printed by order of the House of Commons, and in tables filling 50 folio pages, shows the rates of mortality and the values of annuities on single lives at all ages, among many different classes of annuitants, both separate and combined, the sexes being generally distinguished both in exhibiting the law of mortality and the value of annuities.[§]

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[*] An estimate of the mortality of mankind, drawn from various tables of the births and funerals in the city of Breslau, with an attempt to ascertain the price of annuities upon lives, by Mr. E. Halley, *Transactions of Royal Society*, *London*, vol. xvii., 1693, p. 596, No. 196.

[†] Essai sur les Probabilités de la Durée de la Vie Humaine, 1746.

[‡] Milne on Annuities, 1815. See also two articles by Mr. Milne in Encyclopedia Britannica, "Annuities," and "Mortality."

[§] "Annuities," Encyclopedia Britannica, 1831, p. 208.

"The Equitable Assurance Society published in 1834 a valuable abstract of the accumulated facts in their possession, from which Mr. Morgan deduced a table of mortality. The excellent example of the Equitable Society was followed by the Amicable Society. The Societies' abstracts distinguished the persons who entered at each year of age, a point which, it is to be regretted, was neglected in Mr. Finlaison's tables, although the granting of annuities calculated on the lives of persons, sick or healthy—to selected persons in health, particularly at advanced ages, is well known to be, and has since proved, a matter of serious importance in a pecuniary point of view.

"At the suggestion of Dr. Cleland, the civic authorities of Glasgow, with a laudable zeal, enumerated the ages of the population of that city in 1831; and the registration of deaths was so complete, that Mr. Milne was enabled to construct 'a table of mortality, which he expects to publish,' from the observations made in the 10 years, 1820-30. I am not aware that any other set of observations has appeared from which a true life table can be constructed. I have already stated that Sweden is the only *nation* for which tables of this kind have been constructed upon correct principles. France has no accurate life table;* nor have the *data* from which a life table can be constructed, namely, the ages of the living and the dying, ever been published. No life tables have been constructed for the population of Prussia or Austria; but the *data* exist, and have to a certain extent been published, though in forms which present considerable obstacles to the calculation. The census of Prussia, in which the ages are distinguished, is taken every three years; and periodical abstracts of the deaths have been carefully made by Mr. Hoffman. The ages of the living are, however, unfortunately divided in an irregular manner, entirely different from the correct divisions adopted by Mr. Hoffman in the returns of deaths; which renders it impossible, without a preparatory interpolation, to compare the deaths with the living at the several given ages. The same objection applies to the forms of the Austrian returns, which I have had an opportunity of seeing. Registers of deaths are kept by the clergy of the Russian empire; but I am not aware that life tables have been framed for any portion of the Russian population. The census has been taken decennially with great regularity in the United States of America, and the ages are properly distinguished; but abstracts of the registers of deaths have only been published by the cities of New York, Philadelphia, Boston, and some of the more advanced towns, where property has accumulated, and life is watched over with more care or facility than in the back settlements—scantily peopled, with a fluctuating population. No correct life table can therefore be formed for the population of America, until they adopt, in addition to the census, the system of registration which exists in European states."

Since an English life table has now been framed from the necessary data, I venture to express a hope that the facts may be collected and abstracted from which life tables for other nations can be constructed. A comparison of the duration of successive generations in England, France, Prussia, Austria, Russia, America, and other states, would throw much light on the physical condition of the respective populations, and suggest to scientific and benevolent individuals in every country —and to the government—many ways of diminishing the sufferings, and of ameliorating the health and condition of the people; for the longer life of a nation denotes more than it does in an individual—a happier life—a life more exempt from sickness and infirmity—a life of greater energy and industry, of greater experience and wisdom. By these comparisons a noble national emulation might be excited: and rival nations would read of sickness diminished, deformity banished, life saved—of victories over death and the grave—with as much enthusiasm as of victories over each other's armies in the field; and the triumph of one would not be the humiliation of the other; for in this contention none could lose territory, or honour, or blood, but all would gain strength.

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* Duvillard states that his table, which is used by French life offices, and is given every year in the *Annuaire de France*, was founded on 100,542 deaths, at different ages, in different parts of France, among a population of 2,920,672. He has said very little about the *data*. The mean duration of life in France, according to Duvillard's table, is only 28·76 years. The duration of life is, I believe, longer in England than in any other country; but it is scarcely credible that the lives of Frenchmen should be 12 years shorter than the lives of Englishmen, and 10 years shorter than the lives of Swedes. The table probably involves the same errors as the Northampton table.

"In the years 1840–1 a million children (1,014,461) were born in England, and their births were registered; if the mortality should remain the same, the life table will enable us to follow this million, and determine how many will be alive and how many will die, through the several years of the next century, until they have all "returned to the earth from which they came," and been replaced by other generations destined to pursue the same rounds of life. To bring the observation within narrower limits, let us take 100,000 as the basis of the observation; and from the proportion of the two sexes registered, it will be found that 51,274 of them were boys, 48,726 girls. And here it will be recollected that they are not government annuitants—nor persons who have assured their lives—nor selected lives—nor the inhabitants of any particular town—but the children of all ranks and classes of Englishmen; some of them born in halls and palaces, and surrounded by all the luxuries and conveniences of life; others born in huts on the mountain-side, in the cellars of ill-constructed cities, in lodging-houses, in cottages, farm-houses, or such dwellings as our towns afford. Let it be assumed (and I shall shortly show what reliance can be placed on the latter part of the hypothesis), that the 100,000 were all born on the same day—the 1st of January, 1841; and that the survivors, counted on the first day of 1842, 1843, and of every year for the next 100 years, will exist in the numbers against the respective ages of a table, which I shall call the English life table.

"Of the 100,000 children born, according to the supposition, on January 1st, 1841, only 85,369 were alive on January 1st, 1842. They were exactly a year old, and are placed against the age '1' of the table. 14,631 perished in the first year, the fourth part of them in the first month of life. This is a smaller proportion of deaths than people have been led to suppose occur in the first year; but the facts leave it undoubted that this number of children survived in 1841 out of 100,000 born. On January 1, 1843, the survivors were two years old, and in number 80,102; 5267 died in the second year. On January 1, 1846, the 5th year of age will be attained, and there will be 74,201 living. In the first five years, therefore, 25,799 of the 100,000 children born die; during this period, when they are at home and under the care of the mother, and encounter the contagious diseases which beset the beginning of life, their safety depends very much upon the power of the parents to supply them with food and raiment—upon the mothers' watchfulness and cleanliness—upon the air they are doomed to respire in imprisoned courts and alleys—or in the fresh open atmosphere of healthy country districts. During the next five years, when they leave home more, and when as it appears from the parliamentary returns, great numbers pass part of the day at school, the mortality becomes less considerable; 70,612 are alive at the age of 10; and from 10 to 15, when those 'who labour with their hands' begin to follow the plough—enter the factory—or descend the mine—the loss of life remains small; 68,627 will live to the age of 15. At this age the loss of life among girls is greater than the loss of life among boys, and it continues so for the next five years, when both sexes are more detached from the care of their parents, and the majority pursue the professions or trades by which they afterwards gain a livelihood. The mortality appears to increase rather rapidly from 12 to 15; and then at a slow regular rate from 15 to 55 years: 66,059 attain the age of 20. It was observed that 51,274 boys were born alive to 48,726 girls; but the mortality in infancy is greater among boys than girls; so that 31,958 males attain the age of twenty-five, and 31,623 females attain the age of twenty-four. This is about the average age of marriage in England; and the number of the two sexes is then nearly equal. About four-fifths of the males who attain the age of manhood marry; the proportion of women who marry being the same. It might have been supposed that the peculiar danger which women encounter at this age enhances their mortality; it does so, but less than the mortality of males is increased; 50,301 of the 100,000 persons born attain the age of forty-five; namely, 25,311 men, and 24,990 women. The chance of living from 25 to 45 is rather in favour of English women. The violent deaths of men on rivers, and the sea-coast, in mines, in the streets, in traveling, in their dangerous occupations; the mental agitations and anxieties, terminating unhappily sometimes in suicide—the accumulation of workmen in ill-ventilated shops, or the hard exhausting work of the agricultural labourer, independently of war, and service in unhealthy climates, counterbalance the dangers and sorrows of child-bearing. At the age of 55, this generation will have given birth to, and brought up the generation by which it is to be succeeded; a more rapid rate of mortality will then set in, and more than a thousand die every year; yet 37,996 will be alive at the age of 60, and 24,531 attain the age of 70—11,823 men, and 12,708 women—the mortality of women being less than that of men after 55. The mental faculties, ripened and developed by experience, will not protect the frame from the accelerated and insidious progress of decay; the toil of the labourer, the wear and tear of the artizan, the exhausting passions, the struggles and strains of intellect, and more than all these, the natural falling off of vitality, will reduce the numbers to 9398 by the age of eighty. Here we may pause for a moment. It would formerly have been considered a rash prediction in a matter so uncertain as human life to pretend to assert that 9000 of the children born in 1841 would be alive in 1921; such an announcement would have been received with as much incredulity as Halley's prediction of the return of a comet, after the lapse of 77 years. What knew Halley of the vast realms of ether in which that comet disappeared? Upon what grounds did he dare to expect its reappearance from the distant regions of the heavens? Halley believed in the constancy of the laws of nature; hence he ventured from an observation of parts of the comet's course to calculate the time in which the whole would be described; and it will shortly be proved that the experience of a century has verified quite as remarkable predictions of the duration of human generations; so that, although we little know the labours, the privations, the happiness or misery, the calms or tempests, which are prepared for the next generation of Englishmen, we entertain little doubt that about 9000 of 100,000 of them will be found alive at the distant census in 1921. After the age of 80 the observations grow uncertain; but if we admit their accuracy, 1140 will attain the age of 90; 16 will be centenarians; and of the 100,000, one man and one woman—like the lingering barks of an innumerable convoy—will reach their distant haven in 105 years, and die in 1945.

> Crebrescunt optatæ auræ, purtusque patescit
> Jam propior—

"Without entering into the mathematical details of the question, the nature of the calculation will be readily comprehended. It may have been ascertained that of 100,000 children born in January, 1841, 80,102 were alive in January, 1843; but we could not, of course, if we were so disposed, know by *direct means* how many will live through the year and see 1844: it was, however, ascertained at the census that there were 437,276 children living in 1841 of the age of 2 and under 3 years; and the deaths of 15,027 children of the same age were registered. Hence as 15,270 died to 437,276 living, it is a mere matter of arithmetic to determine how many die and how many survive a year out of 80,102 children exactly 2 years old. According to the table 2710 die out of 80,102, and 77,392 attain the third birth-day, and will be alive on January 1, 1844. The mortality at certain intervals of age can always be determined from a comparison of the numbers living with the deaths: and from the ascertained mortality the annual survivors can be calculated. Thus, in 1841 it was found that 6633 men died at the age 20-25 out of 724,013 living; the mean age of those persons may be taken to be 22½ years; we know the mortality, therefore, at that age, and can tell how many of a given number, say 32,792, aged 22, will live a year—how many of the 100,000 alive on January 1, 1863, will be alive on January 1, 1864. By repeating this calculation at every quinquennial period of life, it becomes evident that the force of mortality is regulated by a law, and may be expressed by regular curves, which can be derived from, and enable us to correct the observations, where they are known to be erroneous from misstatements of age. Experience and the conformity of the observations with this law are the grounds of our confidence in life tables.

"A life table shows, out of a given number born alive, the numbers living at every year of age for 100 or 105 years. The assumed number born alive, technically called the *base* or *radix* of the table, is arbitrary; and the age at which the table terminates varies in different tables. The yearly deaths are called the '*decrements of life.*' In its present form, the life table possesses several remarkable properties. It shows the *probability or chance of living a year or any number of years at any age.* Thus at birth the chance of living a year is ·85369, the chance of dying ·14631; for there are 100,000 chances, and 85,369 in favour of living. At the age of 40 the chance of living a year is $\frac{53,134}{53,825}$, for according to the table the number who die in the next year is 691, and the number who survive is 53,134; so it is 53,134 to 691 that a person aged 40 will live a year. At 60 the chance of living a year is $\frac{36,874}{37,996}$; the denominator of the fraction (37,996) expressing the total number of chances, and the numerator (36,874) the chances in favour of living. The chance of dying is $\frac{1,122}{37,996}$, and the two fractions added together $\frac{36,874+1,122}{37,996} = \frac{37,996}{37,996} = 1$: unity being in the arithmetic of probabilities the symbol of certainty, the certainty that the person will die *or* live, is thus expressed.

"The probable duration of life—the *vie probable* of the French—is seen at once by inspecting the table; it is the time in which the number born is reduced one-half; in the English table, 45½ years. It is probable, or in Halley's words, 'an even wager' that a child will live 45½ years; for the 100,000 are reduced to 50,301 —nearly half their number—by the age 45; there is, therefore, nearly an equal number of chances (50,000) in favour of living to and of dying before the age 45½. The *probable* life of a boy is 44, of a girl 47 years. How long is it probable that a woman aged 25 will live? The 'living' against 25 in the table is 31,337, the half of which is 15,668, a number attained at the age 66; 41 years therefore is the *probable* duration of her life. What is the 'probable life' of a man at the age of 60? The number against the age is 18,808; and the half of 18,808 is 9,404, to which the 18,808 are reduced at the age 73; at 60 therefore it is *probable* that a man will live 13 years.

"Suppose that it were desired to ascertain the influence of factory labour, or any other employment—of residence in a school or in a city; the first point to be determined would be the average probability of life according to the English life table; say that the children enter at 10 years of age, then, as in the table 70,612 is against the age 10, and 68,627 against the age 15, the average probability of living five years is $\frac{68,627}{70,612}$, and the degree in which this probability is diminished or increased measures exactly the influence of the circumstances in which the children are placed.

"Upon adding up the column of 'living' the sum of the numbers will be found to amount to 4,165,890; subtract half 100,000 from this, and 4,115,890, the number of the years which the 100,000 persons live, will be obtained. Divide the years of life 4,115,890, by 100,000, and the quotient, 41·16, will be the mean age. This is called the *expectation of life*—*vie moyenne* of Deparcieux; for males it is 40 years, females 42 years, and for both sexes 41 years. By repeating the process the expectation of life at each year of age is obtained; at five years it is 50 years; at ten 47; at twenty 40; at thirty 34; at forty 27; at fifty 21; at sixty 14, &c., &c. The average age at which persons aged 30 will die is 64 years, and 74 is the average age at which sexagenarians will die.

"The *expectation of life* in the annexed table was calculated separately for males, females, and 'persons;' and as the expectation of life in the first column will generally be found a mean of the expectations in the other two columns, it is a check on the separate calculations. At birth the expectation of females' lives is more by two years than that of males; at 20 it is 40·81 years, that of males being 39·88 years; at 50 the expectation of females is 21·07, that of males 20·02; during the whole period of life after the first year the difference in the expectations does not exceed 1·17 year. This difference is important; but the table disposes of the highly exaggerated opinions as to the superior vitality of the female sex derived from partial observations. I am informed that the lives of females assured are not longer than those of males; which might have been expected, as at assurance offices their state of health is less strictly investigated.

"The life table is easily converted into a population table, showing the total numbers living, and the numbers living at every age. Thus the number of the years of life 4,115,890, would be the population maintained by 100,000 annual births, if the mean duration of life were 41.1589 years; and if there were no emigration the men would differ little in number from the women, the former being 2,060,652, the latter 2,055,238. The annual mortality of persons of all ages would be 1 in 41·16; the annual mortality of persons aged 50 and upwards would be 1 in 20·55, for these are the expectations of life, and in a stationary population the number out of which one dies annually is the mean duration of life in years.

"I am very far from thinking that the use of a national life table in pecuniary transactions is the most important to which it can be applied. It is, nevertheless, this use which led to the study of life contingencies, on which many millions of money are invested; and if England took the lead in the investigation of the value of such contingencies, and can boast of the labours of Halley, De Moivre, Simpson, Price, Morgan, Milne, and other eminent living writers, it must be ascribed in part to the demand for this information in financial and mercantile transactions—another instance of the favourable reaction of the trading interests of the country on the highest departments of science, and on the physical condition of the people."

In the illustrations given by the Registrar-General in relation to the English life table to avoid confusion in the exposition, he assumes the law of mortality as invariable. This assumed uniformity is not intended to imply that the external circumstances in which men live have no influence on the duration of life; it only serves to prove that life being regulated by constant laws, the circumstances adverse or favourable to existence, produced by compensations of various kinds, the same results. The mortality of England, it is well known, varies with every year, and the mortality of 1841 was rather lower than in previous years. Mr. Farr's table therefore may be regarded as a near approximation to a mean table.

Three examples are given to show the application of the table to the determination of the relative duration of life in three different portions of the population of England, viz: the population of Surrey (out of the metropolis,) of the metropolis, and of Liverpool. Surrey shows the rate at which life wastes in the country population; Liverpool is an example at the other extreme, of the effects of concentration in towns, without any adequate provision for removing the effluvia and for securing by art the degree of purity in the dwellings and atmosphere which is partially maintained by nature in an open cultivated country. Surrey, it is stated, has not been selected as the healthiest country, nor must Liverpool be regarded the most unhealthy town in England.

"The population of the extra-metropolitan parts of Surrey," observes Mr. Graham, "happens to be but little more than the population of Liverpool; yet in 1841 the deaths in Surrey were 4256, the deaths in Liverpool 7556. Out of 14,450 boys under 5 years of age, 2087 died in Liverpool; of 14,045 boys in Surrey, only 699 died in the same time. By this immense mortality in Liverpool the number of males living at the age of 10–15 is reduced much below the number in Surrey at a corresponding age; the living in Surrey aged 20–30 are 18,746, but the influx of immigrants into Liverpool raised the number of males living there at that age to 23,494, who are rapidly cut down by sickness and death, so that at the age 45–55, only 7,504 males were enumerated in Liverpool, while 9281 were living in Surrey. From the life tables we shall be able to determine how many survive each successive age, and to calculate the expectation of life.

"According to the Surrey observations 75.423 of 100,000 children born, attain the age of 10 years; 52,060 live to the age of 50; 28,038 to 70; in Liverpool only 48,211 of 100,000 live 10 years; 25,878 live 50 years; and 8,373 live 70 years: in the metropolis 64,921 live 10 years; 41,309 live 50 years; and 16,344 live 70 years. The probable duration of life in Surrey is 53 years, in the metropolis 40 years, in Liverpool 7 or 8 years: the mean duration of life does not differ so enormously; it is, however, 45 years in Surrey, 37 years in the metropolis, and only 26 years in Liverpool; at the age of 30 the expectation of life is 35 years in Surrey, 27 years in Liverpool; at 50 the expectation of life is 21 years in Surrey, 16 years in Liverpool.

"It might be cited as an illustration of the necessity of registration and of calculation in these matters, that, before the annual abstracts of deaths were published, some of the best informed people believed Liverpool one of the healthiest spots in England; and the late Mr. Rickman inserted, doubtless on what he at the time considered good authority, the following note in the population abstracts of 1831: 'The great *increase in the town of Liverpool is attributed to the salubrity of the air*, and the progressive improvement in its trade, commerce, steam navigation, and railroads.' I am not aware that the increase of population in any other localities was ascribed to their noted 'salubrity.'

"It will be seen below that allowing for the increase of population, the mortality in Surrey and in Liverpool was slightly below the average in 1841. It was a little below the average of the three years 1839–41 in the metropolis; but the deaths were less by 7000 than the deaths in 1838.

"I have stated that the mean duration of life in Surrey is about 45, in Liverpool about 26 years; now if all the inhabitants lived 45 years in Surrey and 26 years in Liverpool, the difference would be obvious, but such is not the law of nature; in both a certain number of deaths takes place at all ages, and at the census 3 males and 11 females were returned as living in Liverpool at the advanced age of 95 years and upwards. Little dependence, it is true, can be placed upon the statements of age in the table deduced from the returns in one year (1841) after the age of 90; but it is quite possible that isolated individuals may live 100 years in Liverpool, though they have little or no effect on the average duration of life, which differs from that of Surrey, as has been already seen, in the proportion of 26 to 45 years.

"Addison, in one of his popular papers, 'The Vision of Mirza,' has an allegory which was probably suggested by Halley's table; he compares 'human life to a bridge consisting of threescore and ten entire arches, with several broken arches, which, added to those which were entire, made up the number to about a hundred.' 'I see multitudes of people passing over it,' said he, 'and a black cloud hanging on each end of it. As I looked more attentively, I saw several of the passengers dropping through the bridge into the great tide that flowed underneath it; and upon further examination perceived there were innumerable trap doors that lay concealed in the bridge, which the passengers no sooner trod upon, than they fell through into the tide, and immediately disappeared. These hidden pitfalls were *set very thick at the entrance of the bridge*, so that throngs of people no sooner broke through the cloud, but many of them fell into them. They *grew thinner towards the middle, but multiplied and lay closer together towards the end* of the arches that were entire.' Our life table follows a 'throng' of 100,000 that 'brake through the cloud' into life at the same moment, and counts them as they step on every arch. It shows, therefore, how many fall through the 'hidden pitfalls.' The danger is exactly measured. The arches over which sickly multitudes pass, are the same in number as those traversed by a healthy people; but the 'trap-doors' and 'hidden pitfalls' in their way are twice as numerous, though they can only be perceived by careful observation and counting; while a difference of 26 and 45 'arches' would be obvious to the unassisted eye.

"In the law which regulates the waste of life two things have been reconciled: the uncertainty of the hour of death, and the constancy in the same circumstances of the mean duration of man's existence. The days of successive generations are numbered, yet a child born to-day may die in any hour, or minute, of the next *hundred years;* and until a very advanced age the chances always are that the time of death will be several years distant: the danger of death we know varies at different ages, and in different states of health; but if the limit of life be 100 years it is on an average 36,525 to 1 that a person will not die on a given day: 876,615 to 1 that he will not die on a given hour, 52,596,912 to 1 that he will not die at a given minute. These chances—doubled or trebled as life advances—are so low that practically they have little or no influence in ordinary affairs; and as a general rule men have, indeed, no fear of dying upon any *day;* yet the knowledge that they *may* die at any instant, exercises a salutary check upon their conduct; and, notwithstanding its sometimes appalling effects, the changing certainty or uncertainty of life, according to the different aspects and points of view, is in harmony with the feelings, hopes, moral constitution, and destinies of mankind.

"The serious disadvantages which arose from the difficulty of perceiving the changes in the duration of life, and consequently the influence of external causes upon health and longevity, has now been overcome in this country by the arduous labours of scientific inquirers, and by the conjoint enumeration of the ages of the population and the registration of births and deaths."

The Registrar-General has given seven diagrams in which the differences in the duration of life of various portions of the English population are rendered obvious to the eye. The first is intended to represent the progress of an English generation through life; a light shade indicates the living, a darker shade the dead, at each age out of a given number (100,000) born alive. Vertical lines divided into 10 degrees serve to measure, at every 5th year, the number alive and dead at the respective ages. The other diagrams exhibit the same facts for Surrey, Liverpool, and the metropolis. In *Ireland*, "the expectations of life" are represented as being the same at birth, in the rural districts, as in England. They are less after the age of 20 years, but agree remarkably at all ages with the expectation of life in the metropolis. At birth the expectation is higher in the Irish towns than in Liverpool, but lower than in London. The "expectation of life," therefore, is not so low as it is represented in the tables of the commissioners, which would seem to show that the Irish live only 24 or 29 years, whilst the English live 41. The life tables of the English metropolis, and Liverpool or Manchester, would probably apply to the two sections of the Irish population.

"It is," says the Registrar-General, "a curious feature of the Irish tables that the men appear to live longer than the women in 'rural' districts; and the women longer than the men in 'civic' districts. Frenchmen live longer after 20 than the women, if the expectations of life in the two sexes be equally correct in M. Demonferrand's tables. In England the lives of females exceed those of males by about a year—except at birth when the difference is greater. In Surrey the females from the age of one year and upwards live a little longer than the males; the difference is greater in the metropolis, where it amounts, at some ages, to two or three years. This may, perhaps, account for the differences in the expectations of life deduced from male and female annuitants. According to Mr. Finlaison's tables—the lives of men are from four to six years shorter than those of women; a discrepancy which in its extent is entirely at variance with all other observations. If the majority of the annuitants before 1829 were inhabitants of London, and more than a due proportion of the women lived in the country, such a discordant result would however be produced."

Besides the weekly table of the metropolis, there are now furnished quarterly tables of mortality in 114 of the most populous districts in England, comprising some agricultural parishes and the principal towns. These returns from 571 registers include nearly half the deaths in the kingdom, and being published within a month of the close of every quarter show the sanatary state of the country in a specific and unquestionable form. These tables serve to give almost immediate warning of any great increase in the mortality of particular districts. They must also prove useful in preventing false and mischievous reports, and show where measures are required to improve the sanatary condition of suffering localities.

The subjects embraced in the report of the Registrar-General are of such immense importance, that too much attention cannot well be directed to them by enlightened communities. In a subsequent number we propose to enter into some examination of Mr. Farr's letter, which forms a long appendix to the report. This letter furnishes an abstract of the deaths from small-pox, measles, scarlatina, &c., in the various towns and districts in England, with other topics especially interesting to medical readers and inquirers.

G. E.